# *P.A.S.T. History*

A paper submitted to the inaugural Futureplay Academic conference by

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## Abstract:

In 2001, as I was working on my PhD dissertation, I came upon the world of Massively Multi-Player (MMP) games. This was to be the beginning of a long and arduous road to create the worlds first and only Massively Multi User Physics classroom. While the road ahead is still long, in the last 3 years I have made significant progress in realizing this vision culminating with our present effort, Physics Adventures in Space-Time or PAST.

In this talk, I will start by setting the stage in both the Games arena and the Academic arena. I will then proceed to show some of my early works and current works with PAST. I will conclude with my vision for the future of my project.

I hope that this paper will serve as an abridged review of the rich history these environments have had over the past 30 years as well as putting my current project in context. I also hope that this paper will serve as an inspiration for academics and game makers alike to unite and create the world's next great classroom…online.

## PART I: P.A.S.T's Past

Given the current rage of Multi Player (MP) games such as *Star Wars Galaxies* and *EverQuest II*, people generally assume that MP gaming started with the new millennium. Nothing could be further from the truth. MP games have a history spanning more than 30 years. In this section, I pay homage to those that came before us; to the ground breaking pioneers that set the stage and make it possible for us to realistically consider our visions[1].

### *The First Internet Revolution*

The internet was born, without public fanfare or publicity, in 1969 when ARPAnet was formed. This military project aimed at keeping the lines of communication open across the nation in case of a nuclear strike. The idea that if information is put on the network, it will have many different routes by which to reach its destination is still the basis of today's Internet. Being a military project, it had no exposure to the public and the only other segment that was aware of its existence where academics at the universities that hosted the hardware for ARPAnet.

At the same time as ARPAnet was being developed, a game was developed for PLATO (a computer network system with only 1000 terminals at universities across the nation). This game was called *SpaceWars* and consisted of two triangles on a screen shooting at each other while a central sun constantly pulled them in. The novelty was that the two players in control of the triangles could be geographically remote from one another; in other words, this is the world's first networked MP game (although MP in this case was only two people). Several other two player games followed (including *Dogfight*, a flight simulator) and *Empire*, a Star Trek inspired game which could have up to 32 players.

### *A Brief History of MUD*

This changed in 1978 when Richard Bartle and Roy Trubshaw began to work on a networked game where hundreds of people could play and communicate with each other simultaneously. Called a Multi User Dungeon (MUD), this text based game was based on traditional fantasy archetypes (elves, trolls, dragons) and follows similar rules to the Role Playing games of the time (most noticeably *Dungeons and Dragons*). The game was finalized in 1980 and launched on ARPAnet that same year, thus giving us the first Internet MUD.

Up until the mid-eighties, you could only play these games at universities and then only at the ones big enough to host these system. But with the advent of services like *Genie* and *Compuserve* that first brought networking to the masses, 10 years after the first MUD come to light, there were literally hundreds of MUDs around, sporting names like *TinyMUD, DIKU MUD, FurryMUCK,*

[1] For a more detailed history, go to Raph Koster's timeline at www.legendmud.org/raph/gaming/mudtimeline.html

*LAMDAMoo*, etc). For purposes of our discussion, it is also important to note that in spite of the hundreds of MUDs, it was not until 1991 that the first educational outreach MUD was realized, *MicroMuse*, aimed at the K-12 population.



Figure 1: An EverQuest Screenshot. Each person seen represents a real player somewhere (anywhere) in the world.

By the early nineties, there were hundreds of different MUDs on ARPAnet and other networks. Most of them were text based, although some tried to make it graphical by using Keyboard symbols to "draw" on screen (this is a dragon→"@"...this is you→"&"…this is you attacking the dragon→ "@&"). All this started to change in 1993 with the introduction of Mosaic, the first graphical internet browser. This allowed people to exchange not only text, but graphics and eventually music as well easily over ARPAnet. This set the stage for more introducing true graphics into networking (and not just ASCII symbols)

That same year, the seminal game *Doom* was released and while it had Local Area Net (LAN) MP abilities, it was not truly remote. In 1996 however, the company responsible for *Doom*, ID, created *Quake* as their first real MP offering; it was an instant hit. That same year saw the opening of *Meridian 59 (M59*) and *Ultima Online (UO)* in 1997. These games were remote, networked, graphical role playing games (again not unlike dungeons and dragons) BUT each had over 100,000 players, making them the first true Massively Multi Player (MMP) games. Other notable releases that year include *Lineage*, which currently holds the record from number of players at something like 3 million, mostly from Asia.

While immensely popular to those who knew about these games, they did not make it into popular video game culture. Coin-Slot Video Arcades and consoles like the *Nintendo Entertainment System (NES)* and *Sega Genesis* were still dominant over Personal Computer (PC) games. It wasn't until 1999 and the release of *EverQuest (EQ*; Figure 1) the public imagination was engaged. Next to *UO*, they single handedly created the game genre now known as the Massively Multiplayer Online Role Playing Game or MMORPG (pronounced like its spelled). *EQ* and *UO* are widely recognized as representing the culmination

of the "other" internet revolution, the first generation of graphical internet MMP games.

## *The "Other" Internet Bubble*

With the birth of the Internet as we know in the mid-nineties, several companies jumped on the bandwagon and created businesses built solely on the promise of the future. Unfortunately, the promise was granted, but not to all, thus leading to the infamous "Dot.Com" bubble bursting at the end of the 20th century where hundreds if not thousands of dot.com businesses folded when the promise of the Internet didn't come fast or profitable enough.

At the same time, in the gaming world, the financial potential of MMP games was not lost on the investors and game developers. Both *UO* and *EQ* work on a subscription model where you pay a set amount per month to play the game. Simple math will show you the attractiveness of these games: 100,000 users times 10 USD per month = 1 million dollars monthly. Considering that true populations are two or three times higher and you can see why so many companies dove into the field. Thus at the turn of the millennia, every game studio, every games investor, simply everybody jumped onto the MMP bandwagon. There was a frenzy as every new game seemed to be MMP and seemed to hold the promise of millions to its creator.

However, this was only to mimic the dot.com busts of the late nineties. Of the hundreds of new projects that were started in 2000, 90% were dropped in less than four years and most before release. Despite the dreams of millions of dollars of revenue, most companies did not appreciate the community needs of it's players (a need well established in 30 years of MUDs and immortalized in Dr. Bartle's groundbreaking 1996 paper "*Hearts, Clubs, Diamonds, Spades: Players who suit MUDs*[2]") nor did they appreciate the massive technical and logistical problems to overcome in not only deploying, but more importantly, SUPPORTING these massive communities for one, two or five years. Had they paid attention to history and the lessons of games such as MUD1 which ran, in one form or another, for 20 years, they might not have jumped in so quickly and so naively.

Notable failures include *Majestic*, a game that tried to bring the Online game "out" by making phone calls and emails a part of the game, as well as *World War II* online, a game aimed at recreating the entire theater of war circa 1940-1945. There are however notable success stories. For example, the same team responsible for *EQ* released *Star Wars Galaxy (SWG)* in 2003. Based on the Star Wars franchise, this game has an in-built market due to the amazing success of the Star Wars movies over the last 30 years. Another successful MMP game, *World of Warcraft (WoW)* is based upon the widely successful *Warcraft* strategy games of the nineties and is widely considered as the best game to come from this second generation of MMP games.

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[2] www.mud.co.uk/richard/hcds.htm

## PART II: P.A.S.T's Present

As we saw in the last section, MMP games have a long history spanning over 30 years. However, by the early 21st century, the promise and pain of making MMP games was apparent. As we stand on the threshold of the third generation of Massively Multiplayer Online Games (MMOGs), the lesson is obvious: there is great potential, but it would take a lot of work, commitment, dedication, and research to make this potential work. This was a strong influence as I began thinking about how to make these worlds for Physics and Education in general. To this day, that lesson remains with me. But I'm getting ahead of myself….

### *The Virtual Online Laboratory (VOL)*

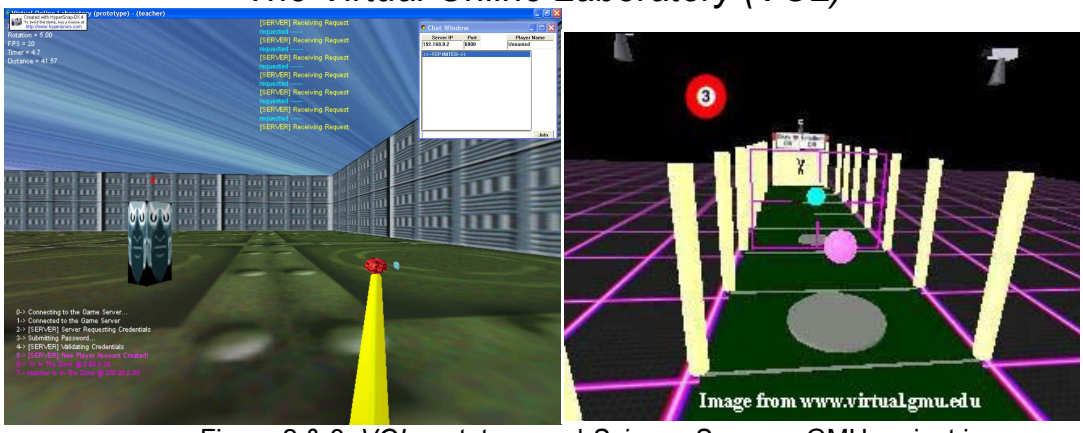


Figure 2 & 3: *VOL* prototype and *Science Space*, a GMU project in collaborative 3d learning simulations

The stage is now set. The year is 2001 and we are in the middle of all the hype over MMP games. The "bubble" won't burst for another year or so and I was working on my PhD. It was here that I encountered *EQ* and became a player within the world. I was immediately "hooked" not only by the game-play, which was innovative by itself, but the strong sense of community I felt towards people that I had only seen and talked with in pixels. I was still playing *EQ* when I finished my dissertation and free from having to think about Physics for a while, I stumbled upon another idea. It was obvious that these games had great appeal to people of all ages. It was also obvious to me that while people came for the game-play, a lot (such as me) kept coming back into the world because of the friends I had online and not so much to play. I thought "Wouldn't it be great if we could engage our students in the same way? If school could be as attractive and as fun as these games are?" The idea seed was planted…

That year, I began to teach Physics at Northern Kentucky University (NKU). I started talking about my idea to my peers, trying to get feedback and encouragement, but no one had a clue what I was talking about. None of my peers had ever played a MMP game (few admitted to playing many video games period) and none could understand the "virtual environment" component of my

idea. Hence, I knew early on I would have to go at it alone. Hence, that summer I started doing my own research into this field and I hired (out of pocket) a NKU Computer Science student to help me. Thanks to him and a recently released book called "Massively Multiplayer Programming" by Todd Barron, we had a prototype of our system up by Fall 2002 dubbed the *Virtual Online Laboratory,* or *VOL*. This prototype aimed at proving a few key points: a) that we could develop a networked application ourselves that could get 4 people online at once and b) that you could mimic physics experiment online.

Points a) was surprisingly easy to accomplish. The book that I was using to start researching MMP programming had with it a pre-built game code (Called *RPGQuest*) that would in fact allow four people to be online simultaneously. All we needed to do was modify the code and content a little to suit our needs. Point b) took a little more thought; I ultimately decided on a model inspired by the MMP games I had played: each player in the world could either measure time or distance but not both. Therefore, individually each can complete some basic measuring assignments, but where incapable of calculating derived quantities, such as velocity, alone. However, if a person could keep time and another would measure distance, collaboratively, they could accomplish this task. Thus our prototype enabled a player to either measure time or distance. In figure 2 we see a screenshot of the prototype. In it, you see a block with a face in front (and a number 2 above); this is another player. The first player is whose view we take thus this screenshot is from the perspective of player 1 in world. The yellow line is a "ruler" which graphically maps the position vector into the world. The distance scalar is also displayed as is the time in the upper left hand corner. The prototype was successful in garnering some interest from colleagues and encouraged me to continue pursuing this goal.

In the course of creating the prototype, I started to do a literature search on other projects that had been done or where currently in production. I found a wealth of Internet Browser-Based educational projects (ie Web Sites and Web Applets), but none that truly embraced the concept of having many people collaborate together towards educational goals. The few projects I did find only engaged a few people at a time or didn't create a sense of community or collaboration.[3] Figure 3 shows a screenshot from one of these projects, George Mason Universities *ScienceSpace*. This was discouraging as it meant that there was no momentum built up in academia (or games industry) for these kinds of ideas. However, I realized that perhaps I had a unique vision after all and that if I didn't pursue it, no one else would and so forged ahead.

[3] Project Science-Space (virtual.gmu.edu)
Project Narrative Immersive Collaborative Environment (www.gse.harvard.edu/%7ededech/muvees)
Project Multi User Virtual Educational Environment (www.evl.uic.edu/tile/nice/nice)

## *The Massively Multi User Synchronous Collaborative Learning Environment (MMUSCLE) system*

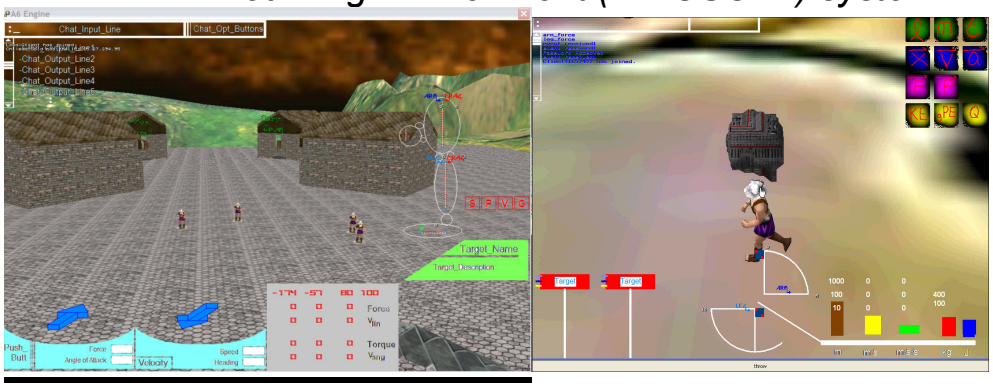


Figure 5&6: Early *MMUSCLE VOL* screenshots.

Following the success with the *VOL*, I began to expand the scope of my thinking: if we can do this for a Physics classroom, what about Biology or History or Art. Why not put every educational subject in an immersive graphical environment where students collaborate with teachers and each other on learning objectives. At the beginning of 2003, I switched to an actual game engine[4] so that instead of modifying code form a book, I could actual develop a game, an educational game; a MP educational game. In celebration of the expansion of the scope of my concept and adopting a robust games authoring software suite to develop it in, I decided to re-label my project the Massively Multi User Synchronous Collaborative Learning Environment, or *The MMUSCLE System*. Thus the *VOL* was merely the Physics extension of the idea. There could also be the *MMUSCLE VHS* (Virtual Historical Simulator) or *MMUSCLE VAG* (Virtual Art Gallery).

The *MMUSCLE VOL* was based on the same principles as the original *VOL*, to allow collaborative learning in a virtual environment; in figure 5 and 6 you see early screenshots of this environment. That shot represents only a few months of learning and developing on our new game engine and was immediately graphically superior to our early prototype in every regard. However, our greatest advancement was in the area of User Interface. As you can see in figure 6, there are several colored panels in the upper right hand corner. These panels can be dragged and dropped on any object in the world. Once dropped, they will display that objects physical parameters, such as position, velocity, momentum or energy. This way a person can easily perform measurements in the world and see the results instantaneously. Another unique aspect of our system was the ability to manipulate physical parameters such as gravity and friction. We can manipulate these in our online simulation so that a student can, for example, experience (virtually) first hand the moon's gravity. Tell a student it's 1/6$^{th}$ of Earth's gravity and they may remember it for the test; let them experience it even indirectly and they will remember it for life. This is the basic premise of the *MMUSCLE* system.

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[4] Conitec's 3D Game Studio (www.conitec.net)


Figure 7, 8, & 9: models of Aristotle, Galileo, and Newton (up);
screenshots of the Greece module (left) and the Italy module (right)

Remembering the lessons of others past failures, I knew that I had to do this the right way the first time around. Mistakes on my part would only hinder efforts of the future. I thus started learning everything I could about game development and project management. The latter is necessary for in order to create, deploy, and maintain these worlds for only by following the best practices coming from the Project Management field could even have a chance at putting together all the different elements needed to make the *MMUSCLE* system. I also learned the best practice from Software Engineering, Hardware Deployment, TCP/IP Networking, etc. Another step I took was in forming my own company, *Futur-E-Scape, LLC*, in order to streamline the production of these projects.

As I was building up my knowledge base in the areas necessary to deploy a MMP, I began to put more "game" into the *MMUSCLE VOL*. This is necessary for the players to be immersed and active in the world. After all, telling students they are going to do the Incline Bench experiment online holds little allure, but maybe meeting Galileo as he is doing it might be more exciting…or maybe even helping Galileo perform the experiment…how about playing pool with Newton or

talking about the Four Elements with Aristotle? Thus, *Physics Adventures in Space Time (PAST)* was born. Think of *PAST* as the game name for the *MMUSCLE VOL*; same educational mission, but now more "player friendly".

In *PAST*, you play the role of an Inter-Dimensional being that has been thrust into our universe (represented as a flying saucer in figure 9). The only way to get back to your own dimension is to learn everything possible about his dimension, starting with Physics. Being from another dimension, space and time have little meaning to you and thus you are free to go to the beginnings or ends of time in your quest for knowledge. Your journey starts in Greece (figure 8) where you will meet and interact with Aristotle and learn about the beginnings of mankind's organizing its environment. Once you have learned all you can from Aristotle, it's off to Italy to meet Galileo and be exposed to basic kinematics and the scientific method. The end of this leg of the journey places you in England where Newton awaits to expose you to dynamics and his three laws.

This plot serves several purposes. It gives players a motivation which will propel them though the several episodes. It serves as a test that the MMUSCLE system can be used for more than just Physics and can in fact teach history as well, even if it's limited to Physics History for the time being.


Figure 10 & 11: Screens showing the character page (left) and the MultiMeter recording page (right) open. In both cases, the velocity is being displayed through our Visible Vector (red "m/s" display attached with a line to the object it's measuring)

While the background story is important, it is irrelevant if we don't have solid physics content as well. As was explained above, each of the three modules touches on a different aspect of Physics and will have different experiment-inspired activities to perform. In figure 10 we see a player (the flying saucer) launch a projectile (the marble column pieces) at several different angles but with the same force. On the left hand side of that screen, you see the a panel open from which the player can modify the Force, Angle, and Mass of the object thrown. It is visually impacting and educationally relevant to see the different parabolic paths that ensue due to the different choices of parameters the student can control. Other experiments include dropping objects down an Incline Bench and performing measurements with variable friction and gravity to study kinematics in Italy or engaging in a game of pool with variable friction and elasticity to study momentum and energy in England.

Following the model of basing our activities on experiments, in figure 11 we see a multi colored display known as the MultiMeter Recorder. With it, once an object has been "tagged" (by dragging and dropping any of the 8 tags you see in the lower right hand corner) you can start to record the output from that tag. Thus, in the recorder you see a time-stamp (blood red; far left) followed by three numbers representing the x, y, and z values of that vector; in this case velocity. In the case of a scalar, only the time-stamp and one additional column are displayed. The student will now be able to select any of these data points and drag them onto their assignment sheet to answer questions. This way, a student can easily perform traditionally tedious and time consuming experiments quickly and efficiently.

The physics content for *PAST* is hard-coded into the simulation and thus at present does not allow teachers to submit their own content or form their own questions. This is done on purpose since teaching teachers how to create content in-world would be very cost-ineffective, but teaching teachers how to USE the tools we have provided for them in-world is very easy and has a rich tradition in games in the form of the "tutorial" level that aims at introducing the player to the environment.

## PART III: P.A.S.T's Future

For most of its life, this project has been a solo venture and funded out of the authors (and friends and families) pocket. In 2004, I submitted two National Science Foundation (NSF) grants and both were rejected. However, in 2005, the project finally succeeded in obtaining a grant. Allied with Merrilea Mayo of the National Academy of Science and Jan Cannon-Bower of the University of Central Florida, we submitted and almost immediately received approval for a NSF Alternative Learning Grant (ALT) entitled *"The Effectiveness of Massively Multi-Player, Game-Based learning in Science Education*". This 3 year grant will help us scientifically and methodically asses the potential for these environments. This is what I've been after the whole time. After all, I'm not so presumptuous to assume that these environments will help our students just because I think they will. I and my collaborators have a gut feeling that these systems have true potential for the future of education and our studies will put a scientific veneer to this feeling. This however doesn't represent the entire future of the *MMUSCLE* system.

In addition to having the assessment support from the grant, project *MMUSCLE* also has the financial support of my company. I have built my company up so that it may independently commercialize and support these environments by relying on a foundation of Resource Production, Code Creation, and Hosting Solutions. The key to our success is using low-cost middleware technologies (ie "don't reinvent the wheel"), using low cost equipment to develop and deploy the system on (and not 10 thousand dollar servers), and start with a small population of only a few thousands to beta-test our environment before we deploy it to millions. This coupled with a personal commitment to Best Practices in all areas, from Project Management to IP law, is my way of guaranteeing that our system will stand the greatest chance to be deployed and be successful in the next few years.

*I strongly believe that the next 3 years will see another revolution. Based on our efforts through the grant and through my company, we should soon see the idea of a MMP classroom gaining acceptance throughout the land. We believe and will prove that these environments hold the promise for tomorrows students. It is my desire to ultimately deploy a complete University's worth of material though the MMUSCLE system. This vision is known as The Vniversity. But that story is left for the future…*